



AST 2034 | Stars and the Nuclear Arms Race

Class Number: 17497

Delivery Method: Primarily Classroom

T/TH | Period 5 (02.00 PM-03.15 PM) Matherly Hall 0107

M/W/F | Period 5 (02.00 PM-03.15 PM) Pugh Hall 170

Instructor Information

Naibi Marinas

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Telephone: (352) 294-1870

Office Hours

MW (12:30 PM - 1:30 PM)

Preferred Method of Communication: Canvas Inbox

Office Location

211-A Bryant Space Science Center

Course Details

Catalog Description: Introduces astronomical events identified as the sites of formation of the heaviest elements in the universe, especially uranium, and their connections to nuclear weapons that have shaped global politics and local environmental policy over the last few generations. This course affords students the ability to critically examine and evaluate the principles of the scientific method, model construction, and use the scientific method to explain natural experiences and phenomena.

Credit Hours: 3

Course Fees: \$0.00

Recommended Materials

DOE FUNDAMENTALS: HANDBOOK NUCLEAR PHYSICS AND REACTOR THEORY

Authors: U.S. DEPARTMENT OF ENERGY

Publisher: U.S. DOE

Edition: NA

A Note on Materials

Supplemental online resources will be shared in the Syllabus and on Canvas frequently.

General Education - Physical Sciences

Successful completion of this course fulfills the General Education Physical Sciences requirement.

Natural Science courses must afford students the ability to critically examine and evaluate the principles of the scientific method, model construction, and use the scientific method to explain natural experiences and phenomena. There are two sub-designations under Natural Science at the University of Florida; Biological Sciences (B) and Physical Sciences (P)

Physical Sciences (P)

Physical science courses provide instruction in the basic concepts, theories and terms of the scientific method in the context of the physical sciences. Courses focus on major scientific developments and their impacts on society, science and the environment, and the relevant processes that govern physical systems. Students will formulate empirically-testable hypotheses derived from the study of physical processes, apply logical reasoning skills through scientific criticism and argument, and apply techniques of discovery and critical thinking to evaluate outcomes of experiments.

Quest

Successful completion of this course fulfills the Quest 2 requirement.

Course Goals and Objectives

This course aims to

1. Expose students to the basic principles of atoms, nuclear reactions and nucleosynthesis in stars.
2. Explore lifecycle of stars, stellar generations and chemical evolution in the universe.
3. Examine the mineral and chemical properties of Uranium on Earth.
4. Teach students the scientific process and how we can understand the Universe using physical laws derived on Earth. Describe the methods used

- by astronomers to determine chemical compositions.
5. Review the major developments in the understanding of nuclear power and major events that have shaped global politics and policies.
 6. Improve scientific literacy. Literacy in the basic concepts and terminology of science is necessary to follow news and make informed decisions (such as voting) on issues that pertain to nuclear power.
 7. Help students learn to communicate scientific ideas clearly and effectively using written or graphic forms.

Expectations and Student Learning Outcomes

CONTENT

- Identify, describe, and explain the basic concepts, theories and terminology of natural science and the scientific method within that discipline.
- Know the major scientific developments within that discipline and the impacts on society and the environment.
- Know relevant processes that govern biological and physical systems within that discipline.
- Identify, describe, and explain the cross disciplinary dimensions of a pressing societal issue or challenge as represented by the physical sciences incorporated into this course.

CRITICAL THINKING

- Formulate empirically testable hypotheses derived from the study of physical processes and living things within that discipline.
- Apply logical reasoning skills effectively through scientific criticism and argument within that discipline.
- Apply techniques of discovery and critical thinking effectively to solve experiments and to evaluate outcomes.
- Critically analyze quantitative data appropriate for informing an approach, policy, or praxis that addresses some dimension of an important societal issue or challenge.

COMMUNICATION

- Develop and present, in terms accessible to an educated public, clear and precise responses to proposed approaches, policies, or practices that address important societal issues or challenges.
- Communicate scientific findings clearly and effectively using oral, written and/or graphic forms.
- Connect course content with critical reflection on their intellectual, personal, and professional development at UF and beyond.

General Education Student Learning Outcomes

*Identify, Describe, And Explain The Basic Concepts, Theories And Terminology Of Natural Science And The Science Method; The Major Science Discoveries

And The Impacts On Society And The Environment; And The Relevant Processes That Govern Biological And Physical Systems.

*Identify, Describe, And Explain The Cross Disciplinary Dimensions Of A Pressing Societal Issue Or Challenge As Represented By The Social Sciences And/Or Biophysical Sciences Incorporated Into The Course.

*Formulate Empirically-Testable Hypotheses Derived From The Study Of Physical Processes Or Living Things; Apply Logical Reasoning Skills Through Science Criticism And Argument; And Apply Techniques Of Discovery And Critical Thinking Effectively To Solve Scientific Problems And To Evaluate Outcomes

*Critically Analyze Quantitative Or Qualitative Data Appropriate For Informing An Approach, Policy, Or Praxis That Addresses Some Dimension Of An Important Societal Issue Or Challenge.

*Develop And Present, In Terms Accessible To An Educated Public, Clear And Eecve Responses To Proposed Approaches, Policies, Or Practices That Address Important Societal Issues Or Challenges.

*Connect Course Content With Critical Reflection On Their Intellectual, Personal, And Professional Development At Uf And Beyond.

Methods of Evaluation

Methods of evaluation. Assignments, Description, Requirements and Points.

Assignment	Description	Requirements	Points
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Assignment	Description	Requirements	Points
Participation in Discussion Sessions and written reflections.	Consistent informed, thoughtful, and considerate class participation is expected and will be evaluated using in-class activities. This class includes Discussion Sessions guided by the TA. During the sessions you will have different activities like (a) written reflections documenting your responses to opinions, events or information taught in class, and communicating your response and thoughts on topics discussed in class. (b) discussions of journal articles and (c) experiments/labs.	500 - 750 words in written reflections Complete lab assignments Response to questions	50
Homework (4 total)	Homework will be assigned to reinforced skills taught in class.	Response to questions	20
Midterm Exam	Formative assessment in the form of multiple choice questions to assess the grasp of course materials and identify areas that need work.	Response to questions	15
Final Exam	Formative assessment in the form of multiple choice questions to assess final review of the topics covered in the course and your knowledge on the subject.	Response to questions	15

Grading Scale

Letter grade and percentage

Letter	Percentage Value
A	94 - 100%
A -	90 - 93%
B +	87 - 89%
B	83 - 86%
B -	80 - 82%
C +	77 - 79%
C	73 - 76%

Letter	Percentage Value
C -	70 - 72%
D +	67 - 69%
D	63 - 66%
D -	60 - 62%
E	59% and below

Minimum Grade Required

A minimum grade of C is required to earn General Education, Quest, and/or Writing Requirement credit. Courses used to satisfy these requirements may not be taken S/U.

Course Schedule

This is a tentative schedule. We will try to follow it as close as possible, but dates when we are covering different topics might change.

Tentative Schedule

Week	Activity	Topic/Assignment
Week 1	Topic	Syllabus, Introduction, Introduction to atoms and spectroscopy.
	Summary	Introduction to class and course policies. Brief introduction to atomic structure, line absorption and emission in gas and plasmas, telescopes and spectrographs and the field of spectroscopy.
	Readings/Works	DOE Handbook, p. 1-16
	Assignment	HW1, In class Discussion 1, In class Energy Levels lab
Week 2	Topic	Stellar spectroscopy. Stellar Properties and Evolution.
	Summary	Stellar composition and spectroscopy. Interior of stars. Nucleosynthesis and formation of chemical elements inside stars, Stellar properties and evolution. The HR diagram.
	Readings/Works	Online reading set "A" DOE Handbook, p. 22-25, 27, 30-35. Online reading set "B" Science Magazine article "Some dead stars may harbor enough uranium to set off a thermonuclear bomb"
	Assignment	HW 2 Spectroscopy Lab, In class Discussion 2
Week 3	Topic	Death of Stars. Origin of Heavy Elements.
	Summary	Cosmic recycling of elements. Neutron Stars. The r-process. Composition of Solar System. Uranium and the Age of the Universe.
	Readings/Work	

Week	Activity	Topic/Assignment
	Assignment	Written Reflections In Class Discussion 3 Midterm Exam (7/17/26)
Week 4	Topic	Uranium and Nuclear Power. The Manhattan Project.
	Summary	Introduction to the development of the field of nuclear physics, the discovery of Uranium and radioactivity and historical encounter of the development of nuclear weapons. Discussion on the development of the Manhattan Project until the building of the first bomb.
	Readings/Work	DOE Handbook, p. 17-21, 48-51, 56-62 Scientific American articles "How long will the world's Uranium supplies last?", "When Uranium Outshines Gold" and "Uranium and Geology" NYT: "Whey they call it the Manhattan Project" Watch movie: "The world after Trinity"
	Assignment	HW 3 Written Reflection
Week 5	Topic	The World After Trinity. Reactions. Uranium as Nuclear Fuel.
	Summary	Discussion and historical perspective on the reaction of scientists and humanity after the events of Trinity and WWII and the push to employing policies. Discussion and reflections on the movie "The world after Trinity" and WWII events post Hiroshima and Nagasaki. Uranium as Nuclear Fuel.
	Readings/Work	SA article: What happens during a Nuclear meltdown" NYT article: "Now I am Become Death: The Legacy of the First Nuclear Bomb Test.
	Assignment	Written Reflection HW4
Week 6	Topic	Nuclear Power and Energy.
	Summary	Nuclear Power Plants and Reactors. Nuclear Fuel cycle. Accidents. A discussion on the continuing Uranium enrichment, Present Day Arms Race and Nuclear Power as energy.
	Readings/Work	SA article: "Smarter use of Nuclear waste" Current news article on Nuclear Arms Race.
	Assignment	Written Reflection Final Exam (8/7/26)

Alignment of SLOs

Content: Exams and homework.

Critical Thinking: Written reflections, in-class work.

Communication: Written reflections, in-class discussions.

University Policies and Resources

Information about grading policies, support for students with disabilities, course evaluations, the Honor Code, and other course policies and campus resources can be found on the [Syllabus Policies page](#).

Attendance Policy

Excused and Unexcused Absences

Students may only participate in classes if they are registered officially or approved to audit with evidence of having paid audit fees. The Office of the University Registrar provides official class rolls to instructors.

Students are responsible for satisfying all academic objectives as defined by the instructor. Absences count from the first-class meeting.

Acceptable reasons for absence from or failure to engage in class include illness; Title IX-related situations; serious accidents or emergencies affecting the student, their roommates, or their family; special curricular requirements (e.g., judging trips, field trips, professional conferences); military obligation; severe weather conditions that prevent class participation; religious holidays; participation in official university activities (e.g., music performances, athletic competition, debate); and court-imposed legal obligations (e.g., jury duty or subpoena). Other reasons (e.g., a job interview or club activity) may be deemed acceptable if approved by the instructor.

For all planned absences, a student in a situation that allows an excused absence from a class, or any required class activity must inform the instructor as early as possible prior to the class. For all unplanned absences because of accidents or emergency situations, students should contact their instructor as soon as conditions permit.

Students shall be permitted a reasonable amount of time to make up the material or activities covered during absence from class or inability to engage in class activities because of the reasons outlined above.

If a student does not participate in at least one of the first two class meetings of a course or laboratory in which they are registered, and they have not contacted the department to indicate their intent, the student can be dropped from the course. Students must not assume that they will be dropped, however. The department will notify students if they have been dropped from a course or laboratory.

The university recognizes the right of the instructor to make attendance mandatory and require documentation for absences (except for religious holidays), missed work, or inability to fully engage in class. After due warning, an instructor can prohibit further attendance and subsequently assign a failing grade for excessive absences.

Religious Holidays Guidelines

At the University of Florida, students and faculty work together to allow students the opportunity to observe the holy days of their faith. A student should inform the faculty member of the religious observances of their faith that will conflict with class attendance, with tests or examinations, or with other class activities prior to the class or occurrence of that test or activity. The faculty member is then obligated to accommodate that particular student's religious observances. Because students represent a myriad of cultures and many faiths, the University of Florida is not able to assure that scheduled academic activities do not conflict with the holy days of all religious groups. Accordingly, individual students should make their need for an excused absence known in advance of the scheduled activities.

The Florida Board of Education and state law govern university policy regarding observance of religious holidays.

Guidelines

- Students, upon prior notification to their instructors, shall be excused from class or other scheduled academic activity to observe a religious holy day of their faith.
- Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence.
- Students shall not be penalized due to absence from class or other scheduled academic activity because of religious observances.

If a faculty member is informed of or is aware that a significant number of students are likely to be absent from class because of a religious observance,

the faculty member should not schedule a major exam or other academic event at that time.

A student who is to be excused from class for a religious observance is not required to provide a second party certification of the reason for the absence. Furthermore, a student who believes that they have been unreasonably denied an education benefit due to religious beliefs or practices may seek redress through the student grievance procedure.

Absence due to Illness

A student who is absent from class or any required class-related activity because of illness should contact their instructor, if feasible, as early as possible prior to the missed class or activity.

Students shall be permitted a reasonable amount of time to make up the material or activities covered during an excused absence.

Students should contact their college by the deadline to drop a course for medical reasons. Students can petition the Dean of Students Office to drop a course for medical reasons. The university's policy regarding medical excuse from classes is maintained by the Student Health Care Center.

Twelve-Day Rule

Students who participate in university-sponsored athletic or scholarly activities are permitted to be absent 12 scholastic days per semester without penalty. A scholastic day is any day on which regular class work is scheduled as defined in the approved university calendar. [More Info](#)

The student or student's advisor must notify the instructor as early as possible prior to the anticipated absence to allow ample time for accommodations. Instructors must be flexible and not penalize students when re-scheduling during-term and final exams, class assignments, and other required activities and must follow the UF Attendance Policy herein and UF Examination Policies. As noted in the UF Examination Policies, during-term exams should be re-scheduled no later than before the end of the semester, while final exams no later than 90 days after the originally scheduled exam time. However, instructors are encouraged to re-schedule final and during-term exams, assignments, and other activities as soon as possible after the last day of the absence and must not penalize the student in any way. [More Info](#)

A group's schedule that requires absence of more than 12 scholastic days should be adjusted so that no student is absent from campus more than 12 scholastic days. Students who previously have been warned in writing by their instructor about the impact of absences on their individual class performance should not incur additional absences, even if they have not been absent 12 scholastic days. The student is responsible to maintain satisfactory academic performance and attendance.